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Science under Siege? Being alongside the life sciences, giving science life

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Abstract

The aim in this paper is to explore conditions of possibility for giving life to science in the context of science being under siege from twin agendas of industrialization and managerialization. The focus of this exploration is my experiencing a shift from being brought in as an ally in the strategic conduct of others to then becoming engaged in the life sciences of ageing. In nuancing these different ways of 'being alongside' (Latimer 2013), I show how social and life scientist's attachment and detachment to things can bring them into an intimate entanglement with each other's world-making. Keeping in view possibilities for breaching the dividing practices by which each of us are emplaced, as either life scientist or social scientist, I focus on gatherings that give science life and so get beyond things as "*as others want them*".

Keywords

Being alongside, collaboration, entanglement, gathering, interdisciplinarity, intimacy, material extension.

Prologue

Stephen Galloway's (2009) novel, "The Cellist of Sarajevo", is about the siege of the city that took place during the Civil War that divided Yugoslavian people between Serbs versus Croats and Muslims versus Christians. The book opens with the Serbs stationed up in the hills surrounding the city and with the Cellist looking out from his apartment at the square where he witnesses a mortar bomb hitting his friends and neighbours queuing for bread at 4 o'clock in the afternoon. He vows to come every day at 4 o'clock to the same spot where they were murdered and play Albinoni's Adagio in the full knowledge that he too could be hit by a sniper or mortar bomb at any moment. This courageous act is much more than a memorial – it is a form of resistance through the intrusion of hope – that the city, like the Adagio, can be reconstructed one day out of burnt and partial fragments.

Kenan, the father of a young family, goes with huge plastic bottles to get water from the other side of the city. The journey, is perilous, as the Cellist's act is perilous, because of the snipers in the hills, waiting to fire in those moments when people are most vulnerable – crossing a bridge, a road junction or a square. On his way to get water, Kenan meets his friend Ismet, a soldier. They greet each other and embrace in the street:

> Kenan asks, 'How are things?'
> Ismet replies 'They are as others want them.'
> [They talk about and make wry jokes about the lack of meat and food.]
> Ismet then pulls out a packet of cigarettes from his pocket, and offers it.
> Keenan refuses. Though he'd like one, he knows Ismet probably has only this pack,

> maybe one other, given to him by the army instead of pay, and when they run out he'll feel it more. Kenan has given up smoking, viewing it as a luxury he can't afford, and he thinks he can stick with it.
> 'Go on, take it, don't be a martyr. It's not my last one.' Ismet pulls a cigarette from the pack and thrusts it into Keenan's hand. 'Do it as a favour to me.'
> The tobacco makes him a little lightheaded but it's good. He's missed this. 'Thanks'
> The two men stand in the street, saying nothing, enjoying a brief moment of silence. There is much to talk about, but none of it can be said, none of it is worth saying. After a while Ismet puts his hand on Keenan's shoulder. 'Good luck with your water. I'll call on you tonight or maybe tomorrow'. He digs his hands into his pockets and continues up the street. (p. 43-44)

A moment of attachment around a cigarette. Ismet pushes the cigarette into Keenan's hand and this seems to call Keenan into a space of intimacy, a gathering of souls where the violence and the demands of their emplacement by the siege is momentarily suspended. A slowing down, against the acceleration of war. Although Ismet says Kenan is doing him a favour, the cigarette is not an 'interessment' device (Callon 1986), through which Kenan's interests can be enrolled and translated, although it does make him pause and interrupt his journey. The cigarette becomes an object that takes on profound implications in its moment of world-making: something larger than their hanging out as friends is being made present and called into 'extension' (Latimer and Munro 2009 drawing on Strathern 1991). Gathering around the smoking of the cigarette creates a moment of affirmation of their capacity as humans to transport themselves into a space outside of the time otherwise constituted '*as others want them*'. Being so gathered shifts them towards 'being alongside' (Latimer 2013) in partial and intermittent connection, even perhaps to an intimate entanglement that enjoins them into recovering a world in common.

As the conditions of siege, and their potentially divisive and demoralizing affects become more and more intense, the people of Sarajevo are increasingly drawn to the cellist and the music in the square - creating possibilities for a 'pulsating' (Simmel 1997 in Beer 2017) intimacy as the gatherings grow larger and larger. By attaching to the cello and gathering in the square around the music of the cellist, Kenan, Ismet and the other dwellers in the city are subverting their emplacement in things 'as others want them'. They are gathering around the materials of their being-in-common (Barad 2007), inciting a sense of belonging and care (Latimer and Puig de la Bellacasa 2013; Puig de la Bellacasa 2017).

Introduction: Science Under Siege

As Berlant (1998) argues to "rethink intimacy is to appraise how we have been and how we live and how we might imagine lives that make more sense than the ones so many are living." (p. 286). In this paper, I focus on the lives of those doing knowledge-making, specifically the relations between life and social sciences. To continue with Berlant, I begin by offering a critical analysis of "the rhetorical and material conditions that enable hegemonic fantasies to thrive in the minds and on the bodies of subjects" (p.286), in this

instance how life and social scientists are subject to the hegemonic fantasies made manifest by the twin strategies of managerialization and industrialization of knowledge-making. In so doing I go on to show how "attachments are developing that might redirect the different routes taken by history and biography" (p.286). Here, I elaborate intimacy as a way to transform interdisciplinarity and collaboration, as a counter-speed politics (*against* acceleration, *for* slowing down). I do this by thinking about interdisciplinarity from the perspective of 'being alongside' life scientists, as a matter of holding onto the partialness and intermittency of connections. I unfold what can happen to collaboration and interdisciplinarity when one cares about the openings that can arise through indirection and juxtaposition, rather than through deliberative or confrontational dialogue.

STS has long focussed on how to grapple with technoscience, even to the point of interceding in how science both develops its interventions and gets translated. Indeed, it has sensed itself very much at the forefront in the arguments for making science more public again, especially in the sense of opening up the life sciences to public scrutiny (Wynne et al 2017). The diverse aims here include finding ways to make science work for the 'commons' by exposing its gods ('nature', 'evolution' and 'natural selection', for example) and, instead, making 'democracy' the arbiter of science's value (Latour 2005). Yet, in supporting public rather than private interests, especially in terms of social justice (Reardon 2017), it may well be the case that these agendas of STS have served as an unwitting ally to quite other forces.

Recent STS scholars, such as Haraway (2008), draw upon the work of Whitehead to extend the notion of 'commons' to a cosmopolitics of a more-than-human world. Specifically, in late capitalism both the life and the social sciences are seen as having become subject to similar social and political forces. On the one hand, as Isabelle Stengers (2018) argues, the industrialisation of science demands it to become faster and faster, especially with neo-liberal ideas of markets setting up laboratories in competition with each other to become more and more productive.[1] At the same time both the social and life sciences have been caught up in the managerialization of public institutions – the supposed freedoms offered by the market one minute then being regulated by an 'iron cage of bureaucracy' that operates in the next. These forms of regulation and accountability not only help create 'audit cultures' (Strathern 2000) that align with governmental strategies under the guise of making science more ethically[2], and publicly

[1] An exemplar of this is the way both the UK Research Excellence Framework and Research Councils have pressed the values of timeliness and impact, culminating in funding now being sponsored by the Department for Business, Energy & Industrial Strategy that emphasises partnerships with industry and the boosting of a nation's economy (DBEI 2017). This cumulative shift towards 'making science pay' applies as much to the life as well as the social sciences and can be understood as directing the use of public money away from building knowledge and informing public policy towards a more explicit and intensive bolstering of capitalist interests (Gardiner 2018).

[2] For the life sciences this includes the Ethical, Legal, and Social Implications Research Program (ELSI) https://www.genome.gov/10001618/the-elsi-research-program/, and Amendments to the regulatory frameworks for use of animals in scientific research (Gov. 2012) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/fil

accountable, but get mainstreamed across European science funding bodies as Responsible Research and Innovation (RRI) programs, including growing debate over how to assess and evaluate when innovation is indeed 'responsible' (Rommetveit et al 2017).

As Strathern (2004) argues this new public management of science has produced a demand for social science scholars to influence the governance of science, including an increasing call for 'interdisciplinarity' and more recently 'collaboration'. How interdisciplinarity and collaboration are to be accomplished, let alone how assessment and evaluation of whether or not any particular innovation is indeed responsible, has thus become the subject of wide debate. For example, in the context of RRI agendas, Delgado and Åm (2018) recently argued that 'interdisciplinarity' and 'collaboration' between the social and the life sciences, as a strategy to ensure that science is done for *the public good*, needs to remain open and experimental, and subject to empirical study.

Rather than enter the debate over how to achieve agendas such as RRI, I want instead to stress how these governance programs align the twin strategies – industrialization and managerialization – so that they not only create opportunities for research but simultaneously impose constraints on how science is done. Specifically, these programs seem to elide the notion of public interest in favour of the push for economic sustainability and growth. There are several critical effects and affects that flow from this. First, there is the kind of constraint which includes, for Stengers, jeopardising the conditions of possibility for intimate knowledge of a subject built over years of immersion, contemplation and collective endeavour. In addition, whenever the meaning of social good gets elided, the academy's status as independent of capitalist interests is also eroded, undermining any lasting hope of directly creating knowledge 'for the *common* good'. Second, there are constraints that end up in a narrowing of focus. In particular, reflecting on the ambition of knowledge production being socially engineered to produce a '*socially* robust science', Strathern suggests that 'interdisciplinarity' is envisioned in these strategies as a way of enlisting 'society' to audit science and make it more accountable on other than its own terms. She begs the question of what might 'count as an adequate description of society in agentive mode, not just there in the background but already caught up (in co-evolutionary fashion) with science?' (p.89). Thirdly, it seems as if these twin agendas look to have co-opted the discourse of making science public, to put science *under siege*, perhaps undermining STS's own project of "resistance to the iron cage of modernity" (Rabinow 2011, p.15).

In thinking through my own encounters with the life sciences of ageing I stress the importance of 'materials of extension' (Latimer and Munro 2006, 2009, drawing on Strathern 1991) not just in science, but to how our relations evolved. Specifically, I show in what follows how our (life scientists and social scientists) gatherings form around the specificities of how we 'attach' to and 'detach' from different materials of extension, specifically 'ageing' and 'the animal', on analogy with the gatherings in the prologue

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e/619140/ConsolidatedASPA1Jan2013.pdf, including the 3Rs (Replacement, Reduction and Refinement of use of animals) https://www.nc3rs.org.uk/the-3rs.

around either a cello or a cigarette. We (life scientists and social scientists) are finding our work is becoming ever more appropriated by technologies of interdisciplinarity and collaboration. In tracing my own encounters with biologists I reflect on how we found ourselves shifting from the formation of a strategic alliance to ways of 'being alongside' each other in partial and intermittent connection (Latimer 2013). So the hegemonic fantasy I debunk in this article goes beyond divisions and oppositions between social and life scientists – often expressed as "Two Cultures" (e.g. Labinger and Collins 2001). More than this, I'm arguing these divisions and oppositions are being deployed and mobilized by the current agendas that are putting 'science under siege'. When the policies aimed at the industrialization and responsibilization of science combine with programmes that promote technologies of interdisciplinarity and collaboration, perhaps even STS's projects risk getting wrapped up in ways that are constituted by agendas "as others want them", as Ismet puts it, making it harder and harder to engage with the things we care about and for?

Entanglement and working with life scientists: research by indirection

The strategies for making science more socially relevant, ethical and 'responsible', position relations between the life and social sciences in very particular ways. Whichever way one looks at it, questions arise over 1) how to work *with* the life sciences that are neither oppositional nor complicit and 2) which resist social science being positioned as the agents of the industrialization and governance of science. In the rest of this paper, using field notes and diary material, I offer an ethnographic description of my experience of researching the life sciences under these conditions of possibility.

This description begins with my field studies on the life sciences focussing on its *interessments*, especially the 'strategic conduct' (Giddens 1984) demanded by the agendas described above, towards ways of relating that foreground what is usually muted: cares, affects and the liveliness of our work (Latimer and Miele 2013; Myers 2015). To this end I draw on my encounterings with biology, and the experience of becoming intimately entangled with the life sciences in ways that have helped me do more than draw a picture of the contours of the biopolitics of ageing (Latimer 2018). Indeed, the emergent effects I describe entail my relations with life scientists shifting, back and forth, between 'becoming-with' (Haraway 2008) and 'being alongside' (Latimer 2013). Specifically, through focussing on our attachment to things that we (life scientists and social scientists) care about – and care for – I illuminate how the things that gather us enables a more explicit rendering of the tensions over how we make matters and meanings have relevance (Safransky 2017). In so doing, sociology and biology are re-gathered around what animates and invigorates the 'ethical doings' (Latimer and Puig de la Bellacasa 2013) that give science life. Through this re-gathering our "being-in-common" is affirmed "in the folds of a society overrun by the simplified messages of late capitalism" (Barad 2007, p. 84).

In this re-focussing of aims, my methodology valorises ongoing experiment in ways that makes a virtue of 'indirection' (Strathern undated). In taking indirection to value serendipity, grasping openings and possibilities as they arise, I perhaps go further than Strathern by drawing on field studies of biology and ageing that began in 2008 and

continue today. So rather than creating a context from which to *launch* an 'interdisciplinary' study, as Strathern does, my aim is to create a position from which to make sense of how relations between us – the life scientists and the sociologist – evolved over time.

In my prologue I touched upon how in the siege of Sarajevo the cigarette and then the cello and the music bring people together, re-gathering themselves in folds outside the time-space as "others want them". While Latour (2005) proposes how objects can be considered as *matters of concern* as well as matters of fact*,* shaping what and how 'things' exist, he does not explore the serendipity of how people become attached and detached from and to things. Gatherings around things can be assemblies of sorts, but I am suggesting that the objects can also be much more than *interessment* devices. As depicted in the novel, this kind of gathering[3] helps persons to *reanimate* a world in common and reaffirm their belonging, their care for each other and the ethicality of their doings.

In order to situate my knowledge-making as 'partial, located and critical' (Haraway 1988 p.584), I reflect upon how this also involved becoming intimately entangled *with* life scientists as a form of 'lively ethnography' (Van Dooren and Rose 2016). Specifically, this work entailed my not just observing and interviewing life scientists, it has involved making things together as well as participation in each other's worlds. In retrospect, some of the more foregrounded and visible aspects of this work together fits Callard and Fitzgerald's (2015) typology for doing interdisciplinary work as 'experimental entanglement' – namely co-authoring, co-experimenting and co-organizing. For example, as well as co-authoring publications and working together on a number of large grant applications, several of my life scientists and I founded a University-wide Network of researchers, including jointly organised public engagement events.

In the descriptions of events in the field that follow, I begin by presenting how I became entangled with the life sciences as an evolving strategic alliance before going on to explore being alongside life scientists in partial and intermittent connection. I emphasise switching between 'becoming-with' life scientists (in strategic if unlikely alliances), and 'being alongside' life scientists (as processes of intimate entanglement in each other's world-making). I explore what 'gathered' us, especially in how we attached and detached to different materials of extension, including each other, or at least what we made each other represent. I go on to discuss how it is through being together in tension that openings for finding (precarious, tentative) common ground are created in between the folds of strategies that emplace us and prefigure our relating. The point here is not to collapse our differences or overcome divisions, but rather to see how and when our attachment reaffirms that which animates and breathes life into our knowledge-making.

[3] In developing the notion of 'gathering' while I am paying attention to Goffman's (1963) typology of interactional events, the resonance here is with Heidegger's (1996) sense of being gathered together.

Encountering Science, Being Strategic

It is 2008. There are calls out from the funding body (RCUK) for research on the *New Dynamics of Ageing*[4]. The program aims to "advance our understanding of the dynamics of ageing from a multidisciplinary perspective". I have been encouraged by the ProVC for Research in my then University to get people together, from across the disciplines, who are interested in ageing. Having a long-standing concern for older people I take the bait.

My Head of School agrees to fund a meeting to which anyone and everyone interested in ageing research from across the University is invited. We are astonished – the room is packed – over 100 people turn up – from Architecture to Dentistry, from English and Philosophy to Health Studies. At the end of the meeting two men are hanging about waiting to speak to me – they look very casual, even scruffy and introduce themselves as Tony[5] (a geneticist) and Jason (a chemical engineer). Tony tells me that ageing is a disease. I laugh and say we need to talk about that. This encounter has the beginnings of an entanglement that involves 'antagonisms' (Nading 2014, p. 11) – this for me may have been a part of the 'lure' (Stronge 2009, drawing on Whitehead) – my wanting to show that ageing and growing old was about much more than a disease.

They suggest I should meet with the person leading the research they are doing on ageing and so, a week later over lunch (them eating something that looks more like a fry-up breakfast), I meet Paul. There's more banter. For example, I comment on the unhealthy nature of their eating habits – given they are supposedly interested in healthy ageing. Tony (who proves to be always affectionately provocative) laughs and says, "ageing is decided by your genes, it doesn't matter what you eat". Much later he tells me if you want to know what your end will be like, take a look at your parents. Even later I discover that he and his wife are scrupulous over their children's 'healthy' diet! So here are the rather lovely tensions we are dealing with: healthy ageing as an effect of genes (Nature) and law-like rules (Daston and Park 2002) versus healthy ageing as an effect of nurture, and 'life's unfolding' (Neilson 2012); and the tension between social gerontology and biology, the tension between life as an effect of material forces and life as socially constructed.

As our encounters develop I am continually figured and positioned. As The Sociologist, I am first figured as someone who thinks that everything is socially constructed. As The Social Scientist, I am next positioned in relation to how the life sciences are being positioned: that is, I am figured as standing for 'Society' in agentive mode to use Strathern's term. To put it another way, the figure I am being made to represent is, in some sort of amorphous way, the Conduit for Making Science More Publicly Accountable. This was explicit in our first grant application together in which my input into the study was described as follows:

> "in line with current policy on connecting public engagement of science and biotechnological development (Wynne et al 2005), we aim to open our work to ethical and community scrutiny as it evolves."

Collaborating with me was presented as helping the scientists fulfil the demand for a

[4] http://www.newdynamics.group.shef.ac.uk

[5] All proper names are pseudonyms.

socially robust science. I am to stand for the 'ethical and community scrutiny', ensuring that the science is being developed for the public good – the only values by which the biology of ageing *should* be judged according to sociologist Bryan Turner (2009). I am also often designated as "fluffy" – perhaps as the Soft Touch. Here my role is to be the Front Woman, the mouthpiece helping to tell and translate their stories about ageing in ways that could make it socially acceptable as at the same as it creates a new sub-discipline, biogerontology: "We've done reproduction and development, ageing is the last great mystery" (Biologist, US, interview 2010).

As things turn out, as well as daily emails and text messages with Paul (I have hundreds of them), the relationship with the group crescendos into frequent visits to me. Encounters include long conversations in which Paul in particular explains biological and scientific things to me, interspersed with many, many moments of me being ribbed and teased. I am also wined and dined, taken to academic meetings, bought first class train tickets and accommodated in lovely, trendy hotels. A lot of work and time goes into this courtship for our future projects! And eventually I am both 'passed' (Garfinkel 1984) as suitable material for our collaboration and then subsequently passed on to colleagues in laboratories across the UK, Europe and the US.

A classic and revealing moment in terms of how I am being figured comes at a big international biogerontology academic meeting in Brighton in 2011. I am walking around the poster room when I hear one of my collaborators talking to someone on the other side of one of the screens. Unaware of my arrival, I hear him say "I have a tame Social Worker with me, Joanna Latimer". When I walk around the poster panel to reveal myself, he blushes. (Fieldnotes, Biogerontology Conference, Brighton, 2011).

In one sense the way I am being figured puts me in the role not of a collaborator in joint epistemic work on what causes ageing or how it can be addressed. Rather in the context of science being under siege, pressed by a managerial agenda demanding 'socially robust science', I discover I am to be figured as a social worker! Someone, seemingly, whose work has the aim of "alleviating the conditions of those people in a community suffering from social deprivation."[6]. Social deprivation in this instance, as I am beginning to understand it, being the lack of recognition given to the future of 'biogerontology'. And, of course, a concomitant absence of funds to secure this status as a reputable, if new, branch of the life sciences.

For my life scientists, much of this growing entanglement is enacted as a game to be played – self-consciously and pragmatically. There is pride in this – that they can pick and choose how they play both the 'fast' science game and the responsibilization of science game, to get what they want – the time, the personnel and the materials to do their experiments, develop their models and solve the puzzles about variations in longevity, and thereby *publish*. At one point, for example, they positively gleamed at having won a grant from a multinational cosmetic manufacturer to pursue their work on understanding the genetic underpinnings of longevity through development of their model of ageing - skin cells from people diagnosed with a premature ageing genetic

[6] Cambridge Dictionary's definition of Social Worker - https://dictionary.cambridge.org/dictionary/english/social-worker accessed August 2018

syndrome. When challenged by me that such cosmetic companies are exploitative of women, their response was that companies such as L'Oréal and Estee Lauder probably commit more money to understanding the basic biology of ageing than any funding body outside of China, because hair and skin are the first things to age. And, further, that L'Oréal has an annual prize actually celebrating Women in Science. So getting in bed with a global cosmetic giant is not a problem for them – it gives them the money and the time to refine their experimental model and move their theories of ageing a step forward, and of course *publish*. Slow science of sorts, accomplished, like my own ethnography, through grabbing piecemeal pots of funding wherever they can.

Strategically, then, things seem to be looking up. I now have access to scientists studying ageing all across the world and surely will manage to bring money into the University as well as get enough data to write my books and papers. So my concerns here pertain in part to my needing to perform 'adequately' to my University as an academic – by getting papers published and winning grants and so on and, if all this sounds like 'strategic conduct' (Giddens 1984), it is surely one aspect of 'being-in-common' in today's world of doing science under siege – social or life. Eben Kirksey (2012) in his anthropological study of occupied West Papua shows that the pragmatic activist movement seeks freedom in entangled worlds through collaborating and building coalitions with unlikely allies.

They, the life scientists, for their part, now had their 'tame social worker'. Yet in letting myself *go along* with these scientists, I am also following medicine back to biology. So, too, I am following science across to ageing, where I had begun my academic life and which I had already shown as being so problematic to medicine and the clinic. At the time I even had thoughts that if one of the most elite groups in the academy – molecular biology – was becoming interested in ageing, then this could perhaps help shift the marginalization of ageing and older people by medicine. So doing ethnography by indirection was not so much a strategy or a plan as it was a way of 'staying with the trouble' (Haraway 2016): a way of relating and a way to renew and refresh what I really cared about.

Whose Social? What Society?

Attaching to each other as unlikely allies was, in the first instance, strategic, and through this we had an exchange of 'goods', sure enough. But our gathering around ageing was also a cause of tension. Specifically, tensions over our ideas about the social, and society, as well as about what 'real science' or 'real sociology' is or ought to be. So – to riff on Latour (2004b) for a moment – there are not only possibilities for asking questions about "Whose Social? What Society? Which Science?", but possibilities for other openings.

As I become entangled by and in molecular biology as it constructs and reconstructs ageing, I increasingly find it to be almost a marginalised group, a pragmatic social movement seeking freedom in tangled-up worlds. Moreover, biology turns out to be surprisingly vulnerable and, more specifically, looks to be 'positioned', like the rest of us, in creating *ageing* as its object (Binstock 2004). For example, from inside social gerontology, the biology of ageing is labelled as 'anti-ageing' and ageist (Vincent et al 2008). It has also been associated with 'Immortalism' (La Fontaine 2009), particularly the

very public and vociferous claims of Aubrey de Grey (e.g. Kichen 2015, Nuland 2005) that humans will be able to live forever by reengineering and reprogramming the ageing body like a complex computer.

At the same time as having to defend itself against claims of being unethical (Caplan 2004), including justifying why it isn't (Bostrom 2005; Gems 2011), biogerontology is problematic for medicine. This is not just because it threatens how medical research and practice are structured around specialisms and individual diseases (Moreira and Palladino 2009). The worry is that, in setting out to cure ageing, biogerontology might actually prevent those diseases that medicine needs for its own justification (House of Lords Science & Technology Select Committee 2005). And, further, it is going against centuries of ageism that position getting old as inevitable, natural, and deeply undesirable (Butler 2001-2). These associations are particularly problematic in terms of demonstrating biology of ageing as a socially robust good, and have been widely debated publically[7], including by Tom Kirkwood (2001) in his Reith Lectures.

At stake are different models of society, not just ideas about what science should or shouldn't be doing. As at the same time as biogerontology needs to enlist 'the public' as allies, it also enacts specific imaginaries over what the body is and what society is. Specifically, I begin to find the science is helping to reimagine not just the natural body as senescent, but how this senescence of the 'natural body' produces senescence of the 'social body' (Douglas 2003). For example, when I visit the laboratory where my collaborators are experimenting with skin cells, they show me some cells under the microscope. When I am looking down the microscope (Figure 1) one of my scientists is telling me that I am looking at senescent skin cells, and he describes these as cells that cannot replicate ('reproduce'). As such they just sit around, causing problems, clogging up the place. Just as older people are to the 'social body', old cells are to the 'natural body' - deeply problematic.

Biogerontology raises the question of whether society needs 'curing' of ageing by senescence enacting 'resource exhaustion' (WHO, 2002) at the level of both the natural and social body. Simultaneously, and I find this over and over again, biological ageing is also enacted as dynamic and pliant. In this paradox, opportunities arise: the discovery of biological processes that have pathological potential to cause harm, but which are not inevitable because they are 'plastic' and 'malleable' (see also Palladino and Moreira 2009). Many experiments are helping to reveal how ageing can be improved and enhanced (Binstock et al 2006).

[7] For example, in the UK public debates have been held between sociologist Bryan Turner and SENS founder Aubrey de Grey, and, later, between Richard Farragher, a UK biogerontologists, and Aubrey de Grey (Oxford University Biomedical Society 2013, https://www.youtube.com/watch?v=pmaXSu9PqV4), but also in newspapers, and many programs and interviews on TV and the radio.

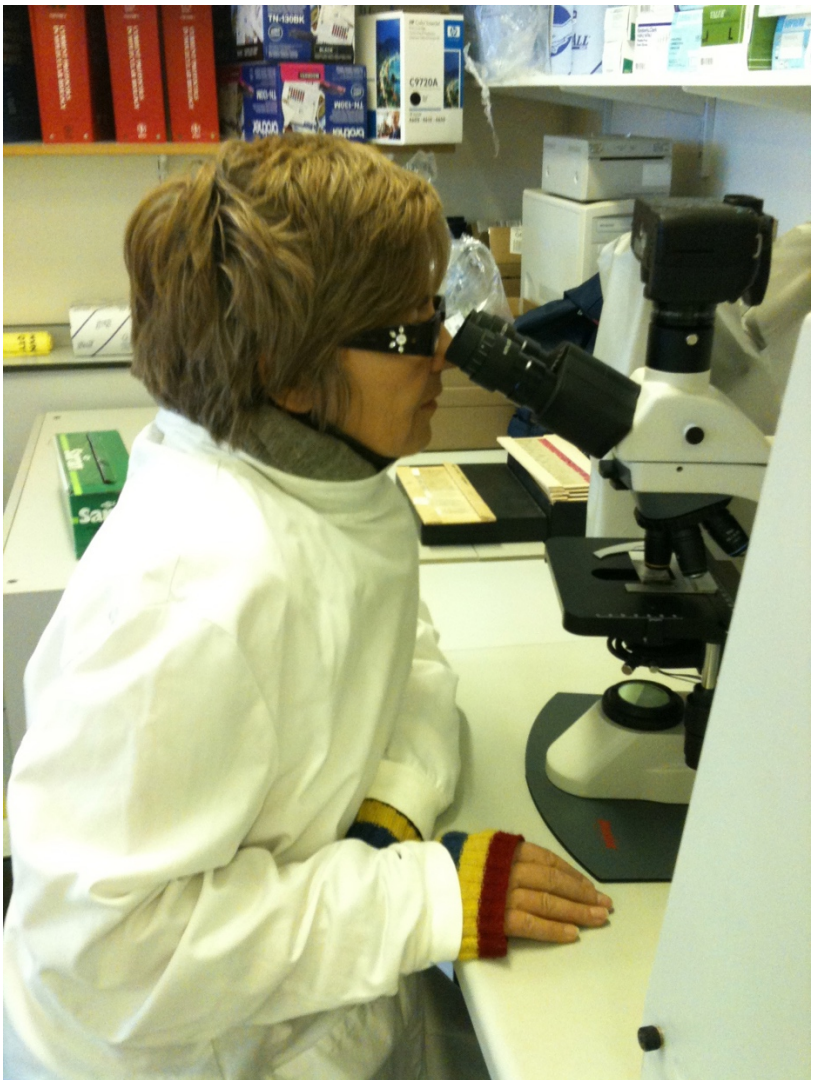

Fig.1 JL Looking at Senescent Skin Cells

Moreover, discourses that emphasise ageing as dynamic, plastic and malleable align the value of extending health and liveliness into old age with questions of productivity, and by extension the economy. On the one hand ageing social and natural bodies are enacted as senescent, degenerating, losing their vitality and (re)productive power, an overstretched ecology threatened by exhaustion. On the other vitality and productivity are figured as molecular, programmed, plastic, and, as available, with the right technoscience, to enhancement. In other words, at our beck and call. As one biologist put it to me: her work on postponing ageing was more valuable than work on single diseases, such as Alzheimer's, "because not only do you not have the disease but you are younger and so you should be more fit and more productive."

At first sight then biogerontology looks protected somewhat from the forces of industrialization and managerialization by its alliance with both biomedicine and public health over doing work that is for the 'social good'. But reinvigorating senescent societies

is a long-term game, and this picture of a protected science is not so clear-cut as it sounds. This is because 'social good', as argued earlier, is more often than not measured against short-term economic gain and pressures for 'fast' science that can deliver short-term technoscientific solutions. That is, there is real pressure for quick technoscientific fixes. Indeed, some scientists, especially but not exclusively in the US, are explicit over the economic gains to be had through re-presenting ageing as dynamic, pliable *and* as postponable, even reversible. The US giants of California's Silicon Valley, in particular, are rapidly investing in the science of ageing (Gorman 2003) – including funding anything from rejuvenating technologies through to genomic tests, that "will one day succeed in making mortal concerns like death optional." (Brown 2018, webpage)

When life scientists press the economic gains of the anti-ageing promissory and circulate the discourse of sciences industrialization as a social good, then I recognise a real tension over how the 'social' and 'society' are being understood. The promissory of a program for how to 'cure' society of ageing's exhausting affects is a risky game, a pragmatist game no doubt of turning opportunities into advantages. But for me ageing is not simply an interessment device – I care about how people grow old, I have cared for older people – and I care about changing the conditions of possibility for people to have a life as they age. I also do not see ageing and the aged as exhausting the natural and the social body. What I see instead are the conditions of neo-liberal capitalism and biological processes as co-producing problems for the natural and social body. In being complicit with the conditions of science under siege, I fear some life sciences may be aiding and abetting nationalisms that celebrate 'youth' as well as modern capitalisms "endless thirst for economic growth and profit, the denial of organic limits" (Bifo 2010). Even denying what gives *it*, that is science, life, and creating the conditions for its own senescence.

Which Science? What Human?

Our forms of relating evolved in ways that went beyond our alliance as strategic. In the beginning, I relied on the serendipity of letting my three scientists take me where they wanted, showing me what they wanted to show me. As things unfold between us, it seems that for them their real *work* goes on between their IMACS and the work in the laboratory. I found this 'disconcerting' (Verran 2011) in the sense that in 2010 I did not really think of computers as where 'real biology' happens, influenced perhaps by those hierarchies of value that get enacted between cell culturing and bioinformatics (see also Lewis and Bartlett 2013).

Increasingly I start to find biological discourse and laboratories full of 'animals' – both human (in the form of the scientists themselves as well as human blood, tissue and cells) and non-human (nematodes, flies, mice and so on), with each scientist shifting between the bench, different machines and the computer. The animal begins to gather the life sciences and I, but no longer as a matter of strategic conduct. On the contrary, 'normal' biology is replete with animals: the animal, and the human-animal relation, is one of the life sciences' key attachments (just think theories of evolution). And the animal is also one of my key attachments, in my life and in my work.

It is around the human-animal relation that the life scientists and I become *intimately* entangled. Paul, for instance, prompts me to question the laboratory scientists

I am investigating about their use of animal models. He also participates more and more in our posthuman seminar series, including helping to organise and conduct a public engagement seminar on human-animal relations as represented in science and contemporary art (Latimer 2012). He not only reads the papers that grow out of what animals mean to me, but comes to my home and gets to know the animals in my world – my family, my dogs, my chickens, my horse. And I become increasingly entangled in how human-non-human relations are enacted in biology, to the point of making animal modelling a focus of study (Friese and Latimer in press). The Animal, as polysemic (Cassidy 2002) and as a multitude and a multiple (Davies 2012), emerges as something that some life scientists and I care for and about – *deeply* (see also Friese, this volume).

It is through the Animal that I have become alongside biology: through our attachment to the Animal we open to being-in-common as a pluriverse (Escobar 2018). For example, in my most recent study of how a Life Sciences' Institute researches life-long health, I am spending the day alongside Lily, a postdoc in an epigenetics laboratory. Lily is doing a stress experiment with nematode worms (*c.elegans*) of different reproductive age, using 'heat shock'. She has prepared her worms over the last week, including feeding the worms, ensuring they do not become contaminated, as well as guaranteeing they live in an environment, the incubator, that is the right temperature. I watch as Lily sits at her microscope, picking worms from the agar plates she has taken from the incubator, placing them on fresh agar plates, in their age groups (each plate containing batches of worms of different chronological age – 2 days, 3 days and 4-5 days). The worms are from a specific germline (a series of genetically related generations) and the timings of their developmental and reproductive life are critical to Lily's experiment. She needs to work with the worms at exactly the right times in their lifecycle - when they have stopped maturing, are of reproductive age, but are not 'too old'. She counts their lifecycle age in terms of how many times they have reproduced – read from the morphology of their vulva. These then are not senescent matter – their value is in their still being reproductive.

Lily tapes up the agar plates she has prepared and puts them in the hot water bath to induce the heat shock. She puts her timer on. It counts in fractions of seconds – the plates have to be immersed for exactly 30 minutes. She prepares her bench to receive the worms once the heat shock is complete, including labelling tiny test tubes in tiny writing (according to each gene to be tested), and placing them in rows in a rack next to her microscope, preparing a liquid nitrogen bath, which she also places on her bench near her microscope. Then we go to lunch. Lily takes the timer with her so that she can get back at exactly the right time for the worms to be stressed but still alive. The seconds tick while we eat, I for one feel nervous, and we have to cut lunch short in order to rescue the worms.

When we get back from lunch, Lily takes the worms out of the heat bath and then works very quickly. She is quiet during this stage of her experiment – and tells me later that this is because she needs to be 'like a robot' and that being robotic is 'good'. I am amazed by her dexterity and by how 'alive' her eyes are as she looks down the microscope, intensely alive with tiny movements and the dilatation and contraction of her pupils - not so much a robot as a 'sensorium' of hands and eyes attuned by and to her instruments and materials (Myers 2015). She puts her plates under the microscope and

picks 50 worms from each one and puts them in the tiny lids of the tiny test-tubes with some of the solution. She shows me the worms in the solution in one of the lids under the microscope – I say, 'They are going ballistic' and look at her – she pulls a sad face and says it is not surprising because they are being lysed (their protective membrane is being broken down by the chemical solution) and 'they are suffering'. She puts the test-tubes on the lids and snaps them shut and then centrifuges them. She then throws the test-tubes into the liquid nitrogen. She does all this quickly for all the heatshock worms – the timing is all. Then she slows down and picks her control worms from different plates (the ones not heat shocked) and puts them in the remaining two test-tubes with the remaining solution and then throws these in the liquid nitrogen. I ask whether that was their death when they were thrown in the liquid nitrogen – she says 'yes, instant death'. After picking the 50 worms from each plate, she threw the plate with the rest of the living worms in the bin.

Lily says that she will go on to extract the dead worms' RNA, then return that to DNA in order to look at how the heat shock affects the genes she has marked, across worms of different chronological ages and across worms that have reproduced a different number of times. In another part of her experiment she will feed some of the worms that she has prepared into a special machine, the Fluidigm, that Lily tells me can do 9,000 experiments overnight, including turning the stuff of her worms into big digital data. Lily also tells me, when she is showing me the Fluidigm machine, that while the data will be analysed by the bioinformatics department, she and her head of lab will also analyse it themselves – because 'they have a hunch' and will be able to understand the significance of the data in the context of the whole experiment. It is at this point that she confides that the success and future funding of the lab, and of her head of lab as well as herself, depends upon this experiment producing results. And that they are only results if they are publishable.

From being alongside this biological work and being shifted alongside Lily by her shifts in extension, I experience how she and others like her are intimately entangled with their animals. One moment the science is grounded in the fleshy, messy worlds of living animals, and the particularities of their bodies' timings and biology, lively things that have their own complexity and demands. The next moment we stand at the digital machine that can help produce big data, information, that if it can be made significant may help stabilise the lab's funding and secure the young scientist's future. As one young scientist put it to me in an interview, the difference between being a scientist and doing the science is that doing the science means 'being married to your [animal] model', something which 'punctualized' (Munro 2004) Lily's life and her routines.

'Science' is of course heterogeneous – not just a two headed Janus (Latour 1987), but a multiple inhabited by multitudes: one minute enacted in the lab attached to animal, the next in a funding application, the next at an academic conference, the next in a board room at a major cosmetic firm, the next attached to the figure of the 'social worker', the next gaming, the next passionate and excited about creating big data out of worm stuff luxuriating in the sensorium of bench work. Here, then, my becoming aligned with the life scientists under siege shifts perspective on what science is and where science is done, and on what it means to be human, and what it means to be animal.

Life Sciences versus Natural Sciences?

Let me return for a moment to my guide into the world of biology, Paul. With some exceptions, rarely do modern day molecular biologists go out into the field to 'Nature'. Instead, like Lily, they bring Nature to the laboratory in ways STS scholars have suggested undermines their capacity to represent Nature (e.g. Knorr-Cetina 1995). But, in being alongside Paul, I am also learning that not going out into the world of 'Nature' also undermines life sciences work, as a *natural* science.

While Paul's formal activities involves playing the game and keeping competitive to fit the limits of doing science under siege, this is only one aspect of Paul-the-scientist I get to know. At some point in our relationship he gradually tells me more and more about something that he is very excited about, including sending me an avalanche of emails, 'phone texts and photographs, and inviting me to like a Facebook community. The focus of these communications are *nudibranch*, commonly known as seasquirts (see figure 2 for one of Paul's photographs).

Fig. 2: One of Paul's Beautiful Photographs of Seasquirts on his Facebook Page

Paul makes me aware of a very different self to that of the scientist good at gaming, or attached to skin cells in the laboratory or the IMAC creating codes for analysing big data, the accoutrements that give the promise of fast science. This self spends almost all his free time doing what he calls 'citizen science': sea diving to observe, swim amongst, photograph, describe and classify different kinds of 'seasquirts'. He relishes telling me that when I swim near a harbour I am probably swimming in an ocean of seasquirt sperm. He also trains in GPS tracking and joins Seasearch and the Marine Conservation Society,

later becoming a Trustee, explaining to me that nudibranch movement and accumulation is a measure of the oceans' diversity, and a way to track global warming and the planet's ecological health.

On the eve of a presentation for a grant application on how the life sciences are remodelling ageing, Paul and I are having dinner. Paul says he is going to be wearing his colourful tie embellished with pictures of crustaceans to the interview. We order our meal – he orders steak and I order lobster (it's a Steak and Lobster restaurant chain), and he ribs me for eating lobster. This is not unusual, many of our interactions involve reference to differences in our ethical ecologies around the animal, especially food. He tells me that lobsters are very intelligent, that they are his friends and that when he is diving he plays with them on the bottom of the sea (see Figure 3).

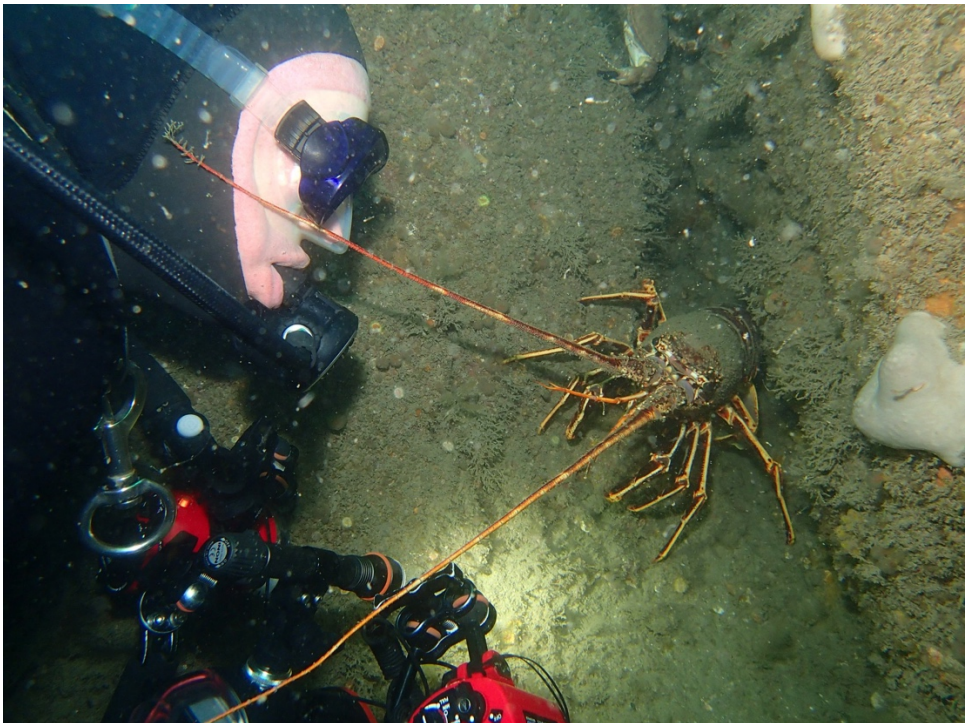

Fig. 3 – Paul playing with a Crustacean on the Bottom of the Sea.

In so doing he is not just letting me know that I am not the only one who cares about the animal. He is showing me I too enact human-animal relations as hierarchies of value. As does he, but his hierarchy is different to mine. For me, lobsters are an edible luxury, while for him lobsters are his sea-diving companions, interesting because they are intelligent and playful, yet prickly and secretive. A reversal of roles perhaps – Paul the sociologist and me the one being exposed? But also, a moment of intimacy – an intimacy that reaffirms us as unlikely allies, as to some extent on the same side, the side of giving science life.

Paul received a highly prestigious award for Natural History and has been made a Fellow of the Linnean Society for his work on nudibranch. He has also recently published a book with his fellow diver-citizen-scientists. However, Paul funds all this work out of his own pocket. Grants for this kind of work, he tells me, are just no longer available. Also, he

doesn't have to write this work into a discourse of grant-gaming. This science is slow, and has no immediate economic gains, it is unmanaged, not industrialized. Yet his attachment to marine diving gathers and performs Paul's multiple matters of concern as a biologist, and as someone who shifts between being a naturalist and being a geneticist. His attachment to seasquirts gathers the complex human-animal relations that make up contemporary biology – being-in-common between living creatures one moment, and hierarchies of difference the next; but it also gathers what he cares *for* and *about.* Genetics, variation, diversity, planetary health – yes; biology, and the value of his discipline's genealogy – yes; but also his freedom and his resistance to being contracted by the conditions of science under siege, of doing science as others want him to.

Giving science life?

Even the displacement of 'matters of interest' by 'matters of concern' (Latimer 1999; see also Latour 2004a, Puig de la Bellacasa 2017) doesn't quite get us out of the conundrum of the object-subject divide materialized in knowledge-making communities. While intervention is usually imagined in terms of opening up the life sciences' blackboxes, and thus influencing not just how technoscience develops but also *what* gets made stable, Latour's (2004b) proposal is for social scientists to learn 'diplomacy', especially in terms of "dissents not only about the identity of humans but also about the cosmos they live in" (p. 451). The difficulty here is that this vision elides how science is under siege on both 'sides' of this diplomacy and thus risks perpetuating division in the name of bringing science into the 'commons'.

Yes, there are switches between digital representations of the human and the non-human animal. And, yes, switches between fleshy human and non-human animals and their parts, but in being alongside the doings of science, what I see enacted are switches between different modes of doing and being human. For Lily, one minute the robotic, the next the carer 'married to their model'. Then 'doing science' as in command and control of 'manipulating' Nature, the next as the analyst and a 'centre of calculation'. One minute she is 'the hands', the next the 'eyes/I'. In the next again, she is once more the head (see also Pallí i Monguilod 2004): shifting between, if you like, lysing and analysing.

In all this the human-animal relation is also being performed: the worm, is valuable matter for the life scientists because as our 'kin' there is enough connection between its DNA and human DNA for it to be able to stand as a hypothesis for shared biological processes. Enough at least for a scientist like Lily to spend real time and energy on its care and on honing the embodied skills needed in order to extract what she and the experiment need from it. Of course, at other moments, the worm's life (as opposed to its matter) is also entirely disposable – it is sacrificable (Birke et al 2007). The scientist's life is thus entangled in and has to articulate with the life of the animal to which they are attached (see also Davies 2012, Friese and Latimer in press, Friese this volume), including that their life is also only of value as long as the scientist can extract value from the animal they are entangled with. The life of the scientist, as well as that of the animal, is giving science life.

Consider Paul swimming and immersing himself in the oceanic underworld, a world of aesthetic pleasure and 'fertility'. A world important to his knowledge-making and to his identity as a 'natural' scientist, but also practices whose effects help keep alive an extension of biology all but denied today in the contemporary context of science under siege. Is this denial of the 'natural' in preference for 'life' because 'natural' science is about knowing by description rather than intervention, and unlikely to produce fast results that can be seen to produce things of *economic* value? And so, in doing this pro bono work, is Paul enacting how it is intimate entanglements with the animal across *all* its manifestations that gives him and contemporary biology *life*? Or even that gives the molecular life?

This is how I and my life scientist colleagues re-gather ourselves around human-animal relations – affirming our 'belongings', our care and our ethical doings. I, as an ethnographer, immerse myself in the matters and meanings of the life sciences world-making across all *its* manifestations. Doing some of this work is also unfunded and takes place in my 'spare' time, but it lets Lily's and Paul's world-making and vulnerabilities move me in ways to give life to my version of the sociology of biology, human-animal relations and ageing. Is it here, despite the tensions, that our being-in-common can be found? Mutual care for and about those things that are easily devalued, marginalized and made vulnerable in between the folds of science under siege.

Concluding Comments

I have shown in this paper how, in being alongside life scientists, in endless conversation and in organizing and in writing, as well as in their laboratories, I was able to identify possibilities for our being-in-common under conditions of science under siege. It is hard to resist the sociopolitical, cultural and material entanglements that institute and re-institute the relation between processes of objectification and the production of knowledge. So my journey involved adopting 'indirection'. This allowed me, as things turned out, to shift out from my simply adding to the strategic agendas of some life scientists - a state of 'becoming with' - towards enjoying periods of intimate entanglement - namely our 'being alongside' in partial and intermittent connection. In my attempting to spell out how we sought to animate and breathe life into our sciences, I want to emphasize that the point was never to collapse our differences or overcome divisions, but rather to come to see and reflect on when our attachment makes explicit the tensions that would normally keep us apart. In gathering around ageing I have described first how, by becoming entangled by life scientists in their emplacement in the twin governance agendas of industrialization and managerialization, I was figured as representing society, 'the public'. This in turn helped me to realise how the biology of ageing is vulnerable, needing to make itself respectable, as about health and the public good. So, I have discussed how ageing societies, on analogy with the ageing body, get presented as exhausted, senescent, as at the same time as they are re-presented as full of potential, especially productive and economic potential. Strategically the life sciences have come to rely upon a presentation of self (Goffman 1959) that enhances the picture of itself as primarily one of intervening in and manipulating the natural world in order to benefit 'Society'. This might be fine enough, were it not for my disconcertment in realising

the extent to which 'Society' is also becoming re-imagined as one beholden to matters of economic value.

All this pressure on the life sciences relies on them representing Nature as matters of fact and the materials with which they manipulate nature as 'natural forces' (Niewöhner 2011). Just as the scientists could be mistaken in how they figured me as 'social work' rather than sociology, so I could have mistaken all they do as 'real science'. But in being alongside the life sciences over a ten-year period, and through pressing the tensions between us, I have arrived at the nubs that gathered us first in a strategic alliance and then re-gathered us as 'beings-in-common'. Being alongside is then always a matter of holding onto the partialness and intermittency of connection.

Yes, moving with life scientists across their attachments and detachments, and getting inside their entanglements, entails subscription to a mode of research that involves indirection. Yet far from losing sight of one's own discipline's attachments and detachments, what I described here is that it is precisely our attachments in common that keep us getting back on track. The differences and tensions between us over those attachments are in a sense what attracts, but they also provide the openings for understanding that what we care for and are committed to, even passionate about: this is to work out how to keep giving our work *life* under the conditions of the siege and things as "others want them".

As at the same time then as showing how relations in both the life sciences and social sciences are positioned and emplaced by the etic values of the twin headed monster of industrialisation and managerialization, I want to claim that we have also created possibilities for gatherings between sociology and biology around matters that matter to us to help affirm, like those people in the Siege of Sarajevo, our 'ethical doings'. And that we have done so not just as these things are constituted by how "others want them", but in ways that help to recover at least some of our attachment to things that we care about and for. In our being alongside each other's Otherness – albeit strategic to begin with – openings began to appear that mattered to both our world-making. Openings through indirection and juxtaposition, rather than through deliberative or confrontational dialogue.

Specifically, I have discussed how both sides, ethnography and laboratory science go about giving science life in ways that are beyond how science is being positioned in relation to notions of public good and economic gain – however much these discourses at times enrol us and are enrolled by us. A dangerous liaison, because intimacy in such circumstances threatens the regimes that prefigure us as divided one moment, or collapsed into an interdisciplinary mulch the next. It is the focus on these moments of gathering that can help us to resist the technologies of interdisciplinarity and unsettle the prescribed role of social sciences as strategic allies interested in making a more responsible, socially robust science.

In closing let me stress how the 'objects' ageing and the animal, like the music and the cello and the cigarette described in my reflections in the prologue on the *Siege of Sarajevo*, became openings. In becoming intimately entangled with the life sciences, not as its auditors, we can like the citizens of Sarajevo resist some of the dividing regimes that position our relating, and open up the fact that what is being blackboxed is not just

knowledge or systems but much of what is vital in what we count to be ourselves and our work. I submit that this is especially true about the tensions, as well as the synergies, over what counts as society, knowledge and being-in-common.

Barad, K. (2007) *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning.* Durham: Duke University Press Books.

Beer, D. (2017) *The Sensory Thresholds of Modernity. Some Reflections on George Simmel's 'Sociology of the Senses'.* *https://thresholdyork.wordpress.com/2017/12/08/the-sensory-thresholds-of-modernity-some-reflections-on-georg-simmels-sociology-of-the-senses/* (accessed August 2018)

Berlant, L. (1998)Intimacy: A Special Issue. *Critical Inquiry*, 24(2): 281-288.

Bifo, F.B. (2010) Exhaustion and Senile Utopia of the Coming European Insurrection. *E-flux* #21. https://www.e-flux.com/journal/21/67655/exhaustion-and-senile-utopia-of-the-coming-european-insurrection/

Binstock, R. H. (2004). The prolonged old, the long-lived society, and the politics of age. In S. G. Post & R. H. Binstock (Eds.) *The Fountain of Youth: Cultural, Scientific, and Ethical Perspectives on a Biomedical Goal. P*p. 362–386.

Binstock R.H., Fishman J.R., and Johnson T.E. (2006). Anti-Aging Medicine and Science: Social Implications. *Handbook of Aging and the Social Sciences*, Sixth Edition. Academic Press. Pp 436-455.

Birke, Lynda, Arnold Arluke, and Mike Michael. 2007. *The Sacrifice: How Scientific Experiments Transform Animals and People*. West Lafayette, IN: Purdue University Press.

Bostrom, N. (2005) The Fable of the Dragon-Tyrant, *Journal of Medical Ethics*, 31(5): 273-277.

Brown, K. (2018) Silicon Valley Is Ready to Spend Millions More on Its Anti-Aging Obsession. January 17th *Gizmodo*, https://gizmodo.com/tag/anti-aging. (accessed February 2018).

Butler, R. N. (2001–2002). Is there an "antiaging" medicine? Generations, 25(4), 63–65.

Callard, F. and Fitzgerald, D. (2015) *Rethinking Interdisciplinarity across the Social Sciences and Neurosciences*. Houndmills, Basingstoke, Hants.: Palgrave Macmillan.

Callon, M. (1986) Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. In: J. Law (ed.), *Power, action and belief: a new sociology of knowledge?* Pp.196-223. London: Routledge.

Caplan, A. L. (2004). An unnatural process: Why it is not inherently wrong to seek a cure for aging. In S. G. Post & R. H. Binstock (Eds.) *The fountain of youth: Cultural, scientific, and ethical perspectives on a biomedical goal*. Pp. 271–285. New York: Oxford University Press.

Cassidy, R. (2002) *The Sport of Kings. Kinship, Class and Thoroughbred Breeding in Newmarket.* Cambridge: Cambridge University Press.

Daston, L. (2010) *Observation as a Way of Life: Time, Attention, Allegory.*The Hans Rausing Lecture 2010 Uppsala University.

https://www.idehist.uu.se/digitalAssets/636/c_636622-l_3-k_salvia_2010.pdf (accessed August 2018)
Daston, L. and Park, K (2002) *Wonders and the Order of Nature: 1150-1750.*Boston, MA: Zone Books.
Davies, G. F. (2012) Caring for the multiple and the multitude: Assembling animal welfare and enabling ethical critique. *Environment and Planning D: Society and Space 30* (4):623-638.
Delgado, A. and Åm, H. (2018) Experiments in interdisciplinarity: Responsible research and innovation and the public good *Plos Biology*, https://doi.org/10.1371/journal.pbio.2003921
Department for Business, Energy & Industrial Strategy(DBEI) (2017) *Industrial Strategy: building a Britain fit for the future.* https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future(accessed August 2018).
Douglas, M. (2003) *Natural Symbols. Explorations in Cosmology.* London: Routledge.
Escobar, A. (2018) Transition Discourses and the Politics of Relationality: Toward Designs for the Pluriverse. In: Bernd Reiter *Pluriverse: The Geopolitics of Knowledge,* Pp. 63-89. Durham: Duke University Press.
Friese, C. & Latimer, J. (in press) Modelling Ageing: Entanglements of Human and Animal Health. *Medical Anthropology Quarterly*.
Galloway S. (2009) *The Cellist of Sarajevo.* London: Atlantic Books.
Gardner, J. (2018) Book Review: Birch, Kean, We Have Never Been Neoliberal: A Manifesto for a doomed Youth. *Social Theory & Health,* 16(4):434–436.
Garfinkel, H. (1984) *Studies in Ethnomethodology*. Cambridge: Polity Press.
Garfinkel, H. and Sacks, H. (1970) On formal structures of practical actions. In J. McKinney and E. Tiryakian (eds.) *Theoretical Sociology.* New York: Appleton-Century-Crofts, pp. 337- 366.
Gems D.(2011). Tragedy and delight: the ethics of decelerated ageing. *Philos Trans R Soc Lond B Biol Sci.*, 366(1561): 108–112.
Giddens, A. (1984) *The Constitution of Society.* Cambridge: Polity Press.
Goffman, E. (1959) *Presentation of Self in Everyday Life.* New York: Penguin Random House.
Goffman, E. (2008) *Behaviour in Public Places*. *Notes on the Social Organization of Gatherings*. New York: The Free Press.
Gorman, J. (2003) *High-Tech Daydreamers Investing In Immortality.* November 1st*New York Times, https://www.nytimes.com/2003/11/01/arts/high-tech-daydreamers-investing-in-immortality.html* (accessed August 2018).
Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. *Feminist Studies, 14*(3), 575-599.
Haraway, D. J. (2008) *When Species Meet*. Minneapolis: Minnesota University Press.
Haraway, D.J. (2016) *Staying with the Trouble.Making Kin in the Chthulucene.*Durham: Duke University Press.
Heidegger M (1996) The question concerning technology. In: Krell DF (ed.) *Martin Heidegger: Basic Writings.* London: Routledge.

House of Lords Science & Technology Select Committee (2005) *Ageing: Scientific Aspects*. London: The Stationery Office.

Kichen, R. (2015) Aubrey de Grey: He wants to live forever — with no underpants. *The Sunday Times*, 17thMay, https://www.thetimes.co.uk/article/aubrey-de-grey-he-wants-to-live-for-ever-with-no-underpants-m5nwx8lbzkf (accessed August 2018).

Kirksey, E. (2012) *Freedom in Entangled Worlds: West Papua and the Architecture of Global Power*. Durham: Duke University Press.

Kirkwood, T. (2001) *The End of Age*, Reith Lectures, BBC Radio 4

Knorr-Cetina, K. (1985) Laboratory Studies: The Cultural Approach to Studying Science. In: Jasanoff S. et al (eds.) *Handbook of Science and Technology Studies*. Pp.140-166. Thousand Oaks, Ca: Sage.

Labinger, J.A. and Collins, H. (2001) *The One Culture? A Conversation about Science.*Chicago: University of Chicago Press.

Lafontaine, C. (2009). Regenerative Medicine's Immortal Body: From the Fight Against Ageing to the Extension of Longevity. *Body and Society,* 15(4): 53-71.

Latimer, J. (2012) Meadow Arts' House of Beasts: Reimagining Human & Non-human Animal Relations at Attingham Park. *Humananimalia* 4(1) http://www.depauw.edu/humanimalia/issue%2007/index.html

Latimer, J. (2013) Being alongside: Rethinking relations amongst different kinds. *Theory, Culture and Society*, 30: 77-104 & Online First

Latimer, J. (2018) Repelling Neoliberal World-making? How the Ageing-Dementia Relation is Reassembling the Social. In: Tyler I. & Slater T. *The Sociology of Stigma*, *The Sociological Review*, 66(4):832-856.

Latimer, J. & Miele, M. (eds.) (2013) Naturecultures: Science, affect and the nonhuman. *Theory, Culture and Society*, 30 (7/8):5-31.

Latimer, J. & Munro, R. (2006) Driving the Social*. The Sociological Review* 54 (1) 32-53.

Latimer, J. and Munro, R. (2009) Keeping & Dwelling: Relational Extension, the Idea of Home, and Otherness. *Space and Culture*, 12 (3): 317-331.

Latour, B. (2004a) Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern. *Critical Inquiry*, 30: 225-248.

Latour, B. (2004b). Whose Cosmos, which Cosmopolitics? Comments on the Peace Terms of Ulrich Beck. *Common Knowledge*, 10 (3): 450-462.

Latour, B. (2005) *From Realpolitik to Dingpolitik – or How to Make Things Public.* In: *Bruno Latour* & Peter Weibel *Making Things Public-Atmospheres of Democracy*. Cambridge, MA: MIT Press.

Lewis J. and Bartlett, A. (2013) Inscribing a discipline: tensions in the field of bioinformatics. New Genetics and Society 32(3): 243–263.

Moreira T. & Palladino P. (2009) Ageing between Gerontology and Biomedicine. *BioSocieties*, 4, 349–365.

Munro, R. (2004) Punctualizing Identity: Time and the Demanding Relation. *Sociology,* 38 (2): 293-311.

Myers, N. (2015) *Rendering Life Molecular: Models, Modelers, and Excitable Matter.* Durham: Duke University Press.

Nading, A. (2014) *Mosquito Trails: Ecology, Health, and the Politics of Entanglement.* Berkeley: University of California Press.
Neilson, B. (2012) Ageing, Experience, Biopolitics: Life's Unfolding. *Body & Society* 18(3&4) 44–71.
Niëwohner, J. (2011) Epigenetics: Embedded Bodies and the Molecularization of Biography and Milieu. *Biosocieties*, 6 (3): 279–298.
Nuland, S. (2005) Do You Want to Live Forever? Aubrey de Grey thinks he knows how to defeat aging. He's brilliant, but is he nuts? February 1, *MIT Technology Review*. https://www.technologyreview.com/s/403654/do-you-want-to-live-forever/ (accessed August 2018).
Pallí i Monguilod, C. (2004) *Entangled Laboratories: Liminal Practices in Science*, PhD Thesis, Universtat Autonoma, Barcelona, Spain. https://core.ac.uk/download/pdf/13277775.pdf (accessed August 2018).
Puig de la Bellacasa, M. (2017) *Matters of Care: Speculative Ethics in More than Human Worlds*. Minneapolis, MN: University of Minnesota Press.
Rabinow, P. (2011) *The Accompaniment. Assembling the Contemporary*. Chicago: University of Chicago Press.
Reardon, J. (2017) *The Post-Genomic Condition. Ethics, Justice and Knowledge After the Genome.* Chicago: University of Chicago Press.
Rommetveit, K., Van Dijk, N., Gunnarsdóttir K., O'Riordan, K., Gutwirth, S., Strand, R., and Wynne, B. (2017) Working responsibly across boundaries: practical and theoretical lessons. In: von Schomberg Rene (ed.) *Handbook of Responsible Innovation.* Edward Elgar Publishing Ltd.
Safransky M. (2017) *The Adventure of Relevance. An Ethics of Social Inquiry*. London: Palgrave MacMillan.
Simmel, G. (1997) 'Sociology of the Senses', in, Frisby, D. & Featherstone, M. (eds) *Simmel on Culture*. London: Sage. pp. 109-119.
Stengers I. (2018) *Another Science is Possible: A Manifesto for Slow Science.* Medford, MA; Polity Press.
Strathern, M. (undated) If I were the ethnographer. Limn. https://limn.it/articles/if-i-were-the-ethnographer/(accessed August 2018).
Strathern, M. (1991) *Partial Connections*. Savage, Maryland: Rowman & Littlefield.
Strathern, M. (2000) *Audit Cultures. Anthropological studies in Accountability, Ethics and the Academy.* London: Routledge.
Strathern, M. (2004) *Commons and borderlands: Working papers on interdisciplinarity, accountability and the flow of knowledge.* Wantage, Oxford: Sean Kingston Publishing.
Strathern, M. (undated) If I were the ethnographer. Limn. https://limn.it/articles/if-i-were-the-ethnographer/(accessed August 2018).
Stronge, P. (2009) Feeling and Finding on the Register of Suggestion: Reflections on the 'Event' of Researching Community Mental Health Care. *The Sociological Review*, 57(2): 240-261.
Turner B (2009) *Can we Live for Ever?* Blackfriars, London: Anthem Press.

Verran H. (2011) Imagining nature politics in the era of Australia's emerging market in environmental services interventions. *The Sociological Review*, 59: 411–431.

Vincent J., Bond J. and Tulle E. (2008) The anti-aging enterprise: science, knowledge, expertise, rhetoric and values. *Journal of Ageing Studies*, 22(4):291-294.

WHO Active Ageing: A Policy Framework (2002) http://www.who.int/?ReturnUrl=http:%2F%2Fwww.who.int%2Fageing%2Fpublications%2Factive_ageing%2Fen%2F(accessed March 2012)

WHO 2011 *Global Health & Ageing* http://www.nia.nih.gov/sites/default/files/global_health_and_aging.pdf (Accessed 2018)

Wynne, B., Wilsdon, J. and Stilgoe, J. (2005). *The Public Value of Science.* London: Demos.

Van Dooren. T. and Rose, D.B. (2016) Lively Ethnography. Storying Animist Worlds *Environmental Humanities,* 8(1): 78-94.